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perceptions, all entirely omitted from the later writings, we are forced to wonder in just what respect they 'stand out more clearly.' Surely these, also, are quite ample to account for the expected enmity of the metaphysicians, logicians, mathematicians, and theologians. It is because of such writings as this that the historical student feels that suspicion as to the author's seriousness, which is stimulated in the general reader by the line of causation noted on p. 193, where the bath tub is reputed first to have transformed the sensualist Englishman to a gentle optimist; then, by cooling his blood, to have created the need for tea-drinking, and thus indirectly to have brought about the increased pleasures of home life and prepared the way for the controlling influence of woman in the modern family. In spite of its frequent brilliancy of suggestion, the student will hardly be able to accept the author's interpretation of the development of English thought as final.

J. H. TUFTS.

THE UNIVERSITY OF CHICAGO.

*The Foundations of Zoölogy.* By WILLIAM KEITH BROOKS, Professor of Zoölogy in the Johns Hopkins University. New York, The Macmillan Company, 1899.—pp. viii, 339.

Columbia University publishes as the fifth volume of its biological series thirteen lectures by Professor Brooks of Johns Hopkins, on "The Principles of Science as Illustrated by Zoölogy." They form a book that is to the philosophical student extremely interesting, though at times difficult and somewhat baffling. The last-named characteristic is due, perhaps, to the great caution with which Professor Brooks guards his statements on all doubtful points, a caution that, on the other hand, gives us the more confidence in his scholarly and scientific spirit. The difficulty of the work, however, is not a little increased by the nature of the author's style, a series of disconnected paragraphs often making it no easy task to follow the argument from page to page. But the volume is one that should be read by everyone who is interested in seeing how certain familiar philosophical problems look from the zoölogist's point of view.

The most important topics discussed in these lectures may be grouped under three heads: first, the significance of the belief held by many biologists that the laws of life are wholly reducible to the mechanical laws of physics and chemistry; second, the strength of the natural selection doctrine and the uselessness of the Lamarckian factor; third, the relation of natural selection to teleology. The first and third problems are brought by Professor Brooks into close relation, and it may be well to discuss his views on the 'acquired character' question before considering his treatment of the relation between a mechanical conception of the universe and philosophy as a whole.

The author defends natural selection against several frequently offered objections, such as that drawn from the persistence of variations whose importance is too slight to be life-saving; and the difficulty, acknowledged by Darwin, of accounting for the great diversity of forms of life represented among the earliest fossils. The consideration of these topics forms one of the most interesting sections of the book, but since its philosophical significance is slight it cannot be discussed here. As regards the Lamarckian factor, Professor Brooks urges in the first place that the fact that use of an organ results in its development is itself an adaptation which must be explained by those who make inheritance of the effects of use the cause of adaptation. It does not seem, however, that this objection would hold against the view that use-inheritance is *one* factor in adaptation, though dependent upon selection for its origin. A similar remark might be made on Professor Brooks's second argument against the inheritance of acquired characters: the argument, namely, that inheritance of the effects of use can cause only adaptations that are of value to the individual, whereas by far the greater number of adaptations have direct reference to the welfare of the species. This, of course, does not prove, and is not meant to prove, that use-inheritance plays no part in development, only that it does not play an important part.

A criticism which the author makes of one of the arguments put forward by Romanes in defense of the Lamarckian factor seems to rest upon a misunderstanding. Romanes, as is known, maintained that the more complicated reflex actions cannot be explained as the products of selection, but are more easily understood as 'inherited habits,' as the organized results of actions which were originally accompanied by intelligence. Professor Brooks objects that this view is inconsistent with the belief held by Romanes that all kinds of action, rational as well as reflex, are purely mechanical in character. How, he asks, if one believes with Romanes that mind can never cause motion, can one find the origin of a reflex act easier to understand on the supposition that it was accompanied by intelligence? It might be answered that the position of Romanes is not at all irreconcilable with belief in the mechanical nature of all action. Without for a moment supposing that consciousness causes movement, one may find the 'inherited habit' theory the easier one because it is based on an undoubted fact in the life history of the individual. We know that certain movements are accompanied by consciousness, and that they are in general those which represent the newer adjustments to environment; such movements tend by repetition to lose their conscious accompaniment and approach the reflex type—a process perhaps, not easy to understand, but yet actual.

This leads us to consider Professor Brooks's treatment of the mechanical theory of life and intelligence. On the claim that the laws of life are reducible to the laws of physics and chemistry, his verdict is 'Not proven'; for, he points out, the essence of a living thing is its fitness to its environment, rather than its structure as such, and for this fitness physics and chemistry furnish as yet no explanation. Further, he reminds us in the lecture on "Paley and the Argument from Contrivance" that no biological truth is more firmly established than the origin of all existing life from preëxistent life—a truth that forms a barrier against the reduction of living and lifeless matter to a common category.

But what will be the effect upon our belief in the value of reason and will if it is sometime proved that the whole of life is governed by one set of mechanical laws? Professor Brooks shows that the third of the problems mentioned above, namely, the relation of natural selection to teleology, takes on a different aspect when considered in connection with the problem of mechanism. Paley's argument, weakened though not destroyed by the natural selection doctrine, is attacked in a new quarter if it becomes conceivable that watches are a part of the chain of physical causation as much as any natural objects. In general, however, the author does not consider the mechanical theory a destructive one; first, because so long as it depends upon scientific research it can involve only the conception of *order*, not that of *necessity*—Professor Brooks objects to the so-called Philosophy of Evolution on account of its unscientific implication that the universe has necessarily developed in one way—and secondly, because so long as mechanism means order and not necessity, it can never exclude from its order any fact like human reason, of whose usefulness we have empirical evidence.

Quite possibly the above statements do not adequately represent the author's position; but he seems not to meet the whole difficulty. There is plenty of evidence that the nervous structures and processes to which human reason corresponds have their importance to the physical order, otherwise they would never have been developed by selection. But what many people would like to know is whether the conscious process itself makes a difference to the physical order. Undoubtedly, as Professor Brooks, following Hume, points out, there is no more intrinsic difficulty in supposing that mind causes motion than in supposing one notion to cause another, since causation is only observed sequence. But there is a difficulty in supposing that an event can be fully accounted for by one set of conditions, and yet depend on another factor as well; that a given action is wholly the result of mechanical processes, and yet caused by a thought process. This is the old, old contradiction that science can never solve, for the only way to avoid it is to hold that the nervous process and the thought process are not two but one, and this science can never warrant us in declaring while object and eject remain on the face of them so absolutely different. The most that science can do is to say that practically belief in mechanism need not trouble us, since, so far as we know, the particular kind of nervous process referred to never occurs without its conscious accompaniment. If we are automata, at least we have no reason to fear that we may become unconscious automata.

MARGARET FLOY WASHBURN.

WELLS COLLEGE.